

In the Claims

Applicant submits below a complete listing of the current claims, including marked-up claims with insertions indicated by underlining and deletions indicated by strikeouts and/or double bracketing. This listing of claims replaces all prior versions, and listings, of claims in the application:

1. (Cancelled)
2. (Currently Amended) The method of claim ~~[[1]]~~ 6, wherein the examination window has an elongated shape.
3. (Previously Presented) The method of claim 2, wherein the smallest dimension of the examination window approximately corresponds to an average diameter expected for the pupil.
4. (Currently Amended) The method of claim ~~[[1]]~~ 6, wherein the largest dimension of the examination window approximately corresponds to an average diameter expected for an iris.
5. (Cancelled)
6. (Currently Amended) A method for selecting an eye image from a set of digital images based on its definition, the method comprising:
calculating a first approximate characteristic definition score based on a cumulating of the gradients in a single direction of light intensities of pixels of an image;
selecting a subset of images for which said first score is greater than a predetermined threshold; and
for each image of the subset of images, calculating a second characteristic definition score by an evaluation method including:

approximately locating a pupil in the image;
defining, from the approximate location of the pupil, an examination window
centered on the approximate location; and
applying a gradient accumulation operation to luminance values of pixels of the
examination window, an accumulating total being proportional to the second characteristic
definition score of the image;

wherein approximately locating a pupil in the image includes:

dividing the image into blocks of identical size, the size is chosen according to an
expected approximate size of the pupil to be located;

calculating, for each block, the average luminance; and

searching for a block having the smallest luminance, an approximate position of the
pupil in the image corresponding to a position of the block having the smallest luminance; and

~~The method of claim 5~~, wherein dividing the image includes dividing the image into blocks which overlap one another, and a pitch in two directions between two overlapping blocks ranges between one tenth and three quarters of the size of the blocks.

7. (Currently Amended) The method of claim [[5]] 6, wherein dividing the image into blocks is performed on a sub-sampled image of the digital image, and a pitch between two neighboring blocks is dependent on the image sub-sampling ratio.

8. (Currently Amended) The method of claim [[5]] 6, wherein approximately locating a pupil in the image is applied to a digital image reduced in size with respect to the original image, the digital image represents the original image with two lateral strips of predetermined width removed.

9. (Currently Amended) The method of claim [[1]] 6, wherein the gradient accumulation operation cumulates a quadratic norm of horizontal and vertical gradients of luminance values of image pixels, the pixels selected at least according to a first maximum luminance threshold of other pixels in the single direction.

10. (Previously Presented) The method of claim 9, wherein the second characteristic definition score is obtained by dividing a running total by a number of cumulated quadratic norms.

11. (Previously Presented) The method of claim 9, further including:
selecting a current pixel having a vertical or horizontal gradient to be taken into account in the total only if luminances of two pixels surrounding the current pixel while being distant therefrom by a predetermined interval in one of the vertical or horizontal directions are smaller than the first luminance threshold, the first threshold being selected according to an expected luminosity of possible specular spots which are desired not to be taken into account, and the interval being selected according to an expected size of the possible specular spots.

12. (Previously Presented) The method of claim 9, wherein the quadratic norm of a gradient is taken into account in the total only if a value of that quadratic norm is smaller than a predetermined gradient threshold, the predetermined gradient threshold being selected according to a contrast of the image.

13. (Previously Presented) The method of claim 9, wherein a current pixel is selected to be taken into account in the total only if a luminance of the current pixel is smaller than a second luminance threshold, the second luminance threshold being chosen to be greater than an expected light intensity of an iris in the image.

14. (Currently Amended) The method of claim [[1]] 6, wherein the second score assigned to each image is used to select the clearest image from said set.

15. (Cancelled)

16. (Previously Presented) The method of claim 2, wherein the examination window has a substantially rectangular shape.

17. (Cancelled)

18. (Cancelled)

19. (Cancelled)

20. (Cancelled)

21. (New) A method for selecting an eye image from a set of digital images based on its definition, the method comprising:

calculating a first approximate characteristic definition score based on a cumulating of the gradients in a single direction of light intensities of pixels of an image;

selecting a subset of images for which said first score is greater than a predetermined threshold; and

for each image of the subset of images, calculating a second characteristic definition score by an evaluation method including:

approximately locating a pupil in the image;

defining, from the approximate location of the pupil, an examination window centered on the approximate location; and

applying a gradient accumulation operation to luminance values of pixels of the examination window, an accumulating total being proportional to the second characteristic definition score of the image;

wherein approximately locating a pupil in the image includes:

dividing the image into blocks of identical size, the size is chosen according to an expected approximate size of the pupil to be located;

calculating, for each block, the average luminance; and

searching for a block having the smallest luminance, an approximate position of the pupil in the image corresponding to a position of the block having the smallest luminance; and

wherein dividing the image into blocks is performed on a sub-sampled image of the digital image, and a pitch between two neighboring blocks is dependent on the image sub-sampling ratio.

22. (New) The method of claim 21, wherein the examination window has an elongated shape.

23. (New) The method of claim 22, wherein the smallest dimension of the examination window approximately corresponds to an average diameter expected for the pupil.

24. (New) The method of claim 21, wherein the largest dimension of the examination window approximately corresponds to an average diameter expected for an iris.

25. (New) The method of claim 21, wherein approximately locating a pupil in the image is applied to a digital image reduced in size with respect to the original image, the digital image represents the original image with two lateral strips of predetermined width removed.

26. (New) The method of claim 21, wherein the gradient accumulation operation cumulates a quadratic norm of horizontal and vertical gradients of luminance values of image pixels, the pixels selected at least according to a first maximum luminance threshold of other pixels in the single direction.

27. (New) The method of claim 26, wherein the second characteristic definition score is obtained by dividing a running total by a number of cumulated quadratic norms.

28. (New) The method of claim 26, further including:
selecting a current pixel having a vertical or horizontal gradient to be taken into account in the total only if luminances of two pixels surrounding the current pixel while being distant therefrom by a predetermined interval in one of the vertical or horizontal directions are smaller than the first luminance threshold, the first threshold being selected according to an expected

luminosity of possible specular spots which are desired not to be taken into account, and the interval being selected according to an expected size of the possible specular spots.

29. (New) The method of claim 26, wherein the quadratic norm of a gradient is taken into account in the total only if a value of that quadratic norm is smaller than a predetermined gradient threshold, the predetermined gradient threshold being selected according to a contrast of the image.

30. (New) The method of claim 26, wherein a current pixel is selected to be taken into account in the total only if a luminance of the current pixel is smaller than a second luminance threshold, the second luminance threshold being chosen to be greater than an expected light intensity of an iris in the image.

31. (New) The method of claim 21, wherein the second score assigned to each image is used to select the clearest image from said set.

32. (New) The method of claim 22, wherein the examination window has a substantially rectangular shape.

33. (New) A method for selecting an eye image from a set of digital images based on its definition, the method comprising:

- calculating a first approximate characteristic definition score based on a cumulating of the gradients in a single direction of light intensities of pixels of an image;

- selecting a subset of images for which said first score is greater than a predetermined threshold; and

- for each image of the subset of images, calculating a second characteristic definition score by an evaluation method including:

 - approximately locating a pupil in the image;

 - defining, from the approximate location of the pupil, an examination window centered on the approximate location; and

applying a gradient accumulation operation to luminance values of pixels of the examination window, an accumulating total being proportional to the second characteristic definition score of the image

wherein approximately locating a pupil in the image includes:

dividing the image into blocks of identical size, the size is chosen according to an expected approximate size of the pupil to be located;

calculating, for each block, the average luminance; and

searching for a block having the smallest luminance, an approximate position of the pupil in the image corresponding to a position of the block having the smallest luminance; and

wherein approximately locating a pupil in the image is applied to a digital image reduced in size with respect to the original image, the digital image represents the original image with two lateral strips of predetermined width removed.

34. (New) The method of claim 33, wherein the examination window has an elongated shape.

35. (New) The method of claim 34, wherein the smallest dimension of the examination window approximately corresponds to an average diameter expected for the pupil.

36. (New) The method of claim 33, wherein the largest dimension of the examination window approximately corresponds to an average diameter expected for an iris.

37. (New) The method of claim 33, wherein the gradient accumulation operation cumulates a quadratic norm of horizontal and vertical gradients of luminance values of image pixels, the pixels selected at least according to a first maximum luminance threshold of other pixels in the single direction.

38. (New) The method of claim 37, wherein the second characteristic definition score is obtained by dividing a running total by a number of cumulated quadratic norms.

39. (New) The method of claim 37, further including:

selecting a current pixel having a vertical or horizontal gradient to be taken into account in the total only if luminances of two pixels surrounding the current pixel while being distant therefrom by a predetermined interval in one of the vertical or horizontal directions are smaller than the first luminance threshold, the first threshold being selected according to an expected luminosity of possible specular spots which are desired not to be taken into account, and the interval being selected according to an expected size of the possible specular spots.

40. (New) The method of claim 37, wherein the quadratic norm of a gradient is taken into account in the total only if a value of that quadratic norm is smaller than a predetermined gradient threshold, the predetermined gradient threshold being selected according to a contrast of the image.

41. (New) The method of claim 37, wherein a current pixel is selected to be taken into account in the total only if a luminance of the current pixel is smaller than a second luminance threshold, the second luminance threshold being chosen to be greater than an expected light intensity of an iris in the image.

42. (New) The method of claim 33, wherein the second score assigned to each image is used to select the clearest image from said set.

43. (New) The method of claim 34, wherein the examination window has a substantially rectangular shape.

44. (New) A method for selecting an eye image from a set of digital images based on its definition, the method comprising:

calculating a first approximate characteristic definition score based on a cumulating of the gradients in a single direction of light intensities of pixels of an image;

selecting a subset of images for which said first score is greater than a predetermined threshold; and

for each image of the subset of images, calculating a second characteristic definition score by an evaluation method including:

approximately locating a pupil in the image;

defining, from the approximate location of the pupil, an examination window centered on the approximate location; and

applying a gradient accumulation operation to luminance values of pixels of the examination window, an accumulating total being proportional to the second characteristic definition score of the image; and

wherein the gradient accumulation operation cumulates a quadratic norm of horizontal and vertical gradients of luminance values of image pixels, the pixels selected at least according to a first maximum luminance threshold of other pixels in the single direction.

45. (New) The method of claim 44, wherein the examination window has an elongated shape.

46. (New) The method of claim 45, wherein the smallest dimension of the examination window approximately corresponds to an average diameter expected for the pupil.

47. (New) The method of claim 44, wherein the largest dimension of the examination window approximately corresponds to an average diameter expected for an iris.

48. (New) The method of claim 44, wherein the second characteristic definition score is obtained by dividing a running total by a number of cumulated quadratic norms.

49. (New) The method of claim 44, wherein approximately locating a pupil in the image includes:

dividing the image into blocks of identical size, the size is chosen according to an expected approximate size of the pupil to be located;

calculating, for each block, the average luminance; and

searching for a block having the smallest luminance, an approximate position of the pupil in the image corresponding to a position of the block having the smallest luminance.

50. (New) The method of claim 44, further including:

selecting a current pixel having a vertical or horizontal gradient to be taken into account in the total only if luminances of two pixels surrounding the current pixel while being distant therefrom by a predetermined interval in one of the vertical or horizontal directions are smaller than the first luminance threshold, the first threshold being selected according to an expected luminosity of possible specular spots which are desired not to be taken into account, and the interval being selected according to an expected size of the possible specular spots.

51. (New) The method of claim 44, wherein the quadratic norm of a gradient is taken into account in the total only if a value of that quadratic norm is smaller than a predetermined gradient threshold, the predetermined gradient threshold being selected according to a contrast of the image.

52. (New) The method of claim 44, wherein a current pixel is selected to be taken into account in the total only if a luminance of the current pixel is smaller than a second luminance threshold, the second luminance threshold being chosen to be greater than an expected light intensity of an iris in the image.

53. (New) The method of claim 44, wherein the second score assigned to each image is used to select the clearest image from said set.

54. (New) The method of claim 45, wherein the examination window has a substantially rectangular shape.